****
SPACE GATEWAY SUPPORT **SGS 02773J (February 2005)**
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DIVISION 02 - SITE CONSTRUCTION

SECTION 02773J

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02/05

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SECTION 02773J

CONCRETE CURB AND GUTTER
02/05

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NOTE: Delete, revise, or add to the text in this section to cover project requirements. Notes are for designer information and will not appear in the final project specification.

This section covers cast-in-place portland cement concrete combination curbs and gutters constructed over a prepared base and subgrade. This section includes:

Sampling and testing proposed concrete and quality-control testing during construction

Placing, finishing, and curing concrete

Expansion-joint fillers and sealants

Protective treatment of concrete surfaces

Clean up and disposal of materials

This section must be coordinated with Section 03305, "Cast-In-Place Concrete (Short Section)," to eliminate duplication, conflict, and ambiguity.

Drawings must include section views through combination curb and gutters, spacing of expansion and contraction joints, reinforcing steel details, and a plan layout of work indicating radius curves, entrances, and cutouts for catch basins or structures.
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PART 1 GENERAL

1.1 REFERENCES

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NOTE: The following references should not be manually edited except to add new references. References not used in the text will automatically be deleted from this section of the project specification.
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The publications listed below form a part of this section to the extent referenced:

ACI INTERNATIONAL (ACI)

ACI 305R	(1999) Hot Weather Concreting
ACI 306R	(1988) Cold Weather Concreting
ACI 315	(1999) Details and Detailing of Concrete Reinforcement
ACI 318/318R	(2002) Building Code Requirements for Structural Concrete and Commentary

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182	(1991; R 2000) Burlap Cloth Made from Jute or Kenaf

ASTM INTERNATIONAL (ASTM)

ASTM A 615/A 615M	(2004) Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
ASTM C 138/C 138M	(2001a) Standard Test Method for Density ("Unit Weight"), Yield, and Air Content (Gravimetric) of Concrete
ASTM C 143/C 143M	(2003) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C 150	(2002ae1) Standard Specification for Portland Cement
ASTM C 171	(2003) Standard Specification for Sheet Materials for Curing Concrete
ASTM C 172	(1999) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C 173/C 173M	(2001e1) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	(2003) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 260	(2001) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C 309	(2003) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C 31	(2000e1) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 33	(2003) Standard Specification for Concrete

	Aggregates
ASTM C 330	(2004) Standard Specification for Lightweight Aggregates for Structural Concrete
ASTM C 618	(2003) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
ASTM C 685/C 685M	(2001) Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C 94/C 94M	(2003a) Standard Specification for Ready-Mixed Concrete
ASTM C 989	(2004) Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars
ASTM D 1190	(1997) Standard Specification for Concrete Joint Sealer, Hot-Applied Elastic Type
ASTM D 1751	(1999) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

1.2 SUBMITTALS

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NOTE: Review submittal description (SD) definitions in Section 01330, "Submittal Procedures," and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control. Include a columnar list of appropriate products and tests beneath each submittal description.

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The following shall be submitted in accordance with Section 01330, "Submittal Procedures," in sufficient detail to show full compliance with the specification:

SD-04 Samples

Samples of each concrete mix shall be submitted in accordance with the paragraph entitled, "Quality Control During Construction," of this section.

SD-05 Design Data

Mix design data shall be submitted for approval of each concrete class in accordance with paragraph entitled, "Concrete-Mix Design," of this section, as required for machine placement. Design for machine placement shall equal or exceed the specified

design.

SD-06 Test Reports

Test reports, except when specified otherwise, shall be submitted for each referenced standard in accordance with paragraph entitled, "Quality Control During Construction," of this section. Additional reports will be required if material source changes, or there is a change in material.

Slump
Compression Test
Concrete Temperature
Air Content
Yield
Air Dried Unit Weight
Unit Weight of Fresh Concrete

SD-07 Certificates

Certificates of compliance shall be submitted for the following items showing conformance with the referenced standards contained in this section. Certificates shall contain project name and number, date, name of Contractor, name of concrete testing service, source of concrete aggregates, material manufacturer, brand name of manufactured materials, material name, values as specified for each material, and test results.

Reinforcing Steel
Form Materials
Curing Materials
Joint Materials
Concrete Materials
Concrete-Mix Design

SD-08 Manufacturer's Instructions

Manufacturer's instructions shall be submitted for Concrete Curbs and Gutters in accordance with paragraph entitled, "Machine Placement," of this section.

1.3 SAMPLING AND TESTING

Sampling and testing services shall be provided by the Contractor. Testing services shall be approved and shall perform sampling and testing to determine conformance to reference specifications and for quality control.

1.4 QUALITY CONTROL DURING CONSTRUCTION

Concrete samples shall be submitted and tested as follows:

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
Sampling	ASTM C 172	As required for each test
Slump	ASTM C 143/C 143M	One for each concrete load, one each time water adjustment is

REQUIREMENT	TEST METHOD	NUMBER OF TESTS
		made, and one for each set of compressive-strength tests
Compression Test specimens	ASTM C 31	One set of six standard cylinders for each compressive-strength test for each 100 25 cubic yards meter
Concrete Temperature		Hourly when air temperature is 40 5 degrees F C and below or 80 26.7 degrees F C and above and each time a set of compressive-test specimens is made
Air Content or by pressure method	ASTM C 173/C 173M ASTM C 231	
Yield	ASTM C 138/C 138M	
[Air Dried Unit Weight]	ASTM C 330	After curing
[Unit Weight of Fresh Concrete	ASTM C 138/C 138M	One for each set compressive strength tests]

1.5 SUBGRADE PREPARATION

Subgrade shall conform to NASA Section 02315, "EXCAVATION AND FILL."

PART 2 PRODUCTS

2.1 REINFORCING STEEL

Reinforcing bars shall be deformed billet steel conforming to ASTM A 615/A 615M. Bars shall be free of rust, mill scale, or a combination of both, clean, straight, and shop fabricated to the length and shape indicated.

2.2 FORM MATERIALS

Forms shall be of ample strength to resist springing during placement of concrete and to remain in vertical and horizontal alignment until they are removed. Forms shall be straight, free of distortion or defects, and extend the full depth of the concrete. Forms shall be substantial and sufficiently tight to prevent leakage of mortar. Defective forms shall be removed and replaced with new or repaired forms as approved at no additional cost to the Government. Forms may be wood or steel.

Form oil shall be a clear compound that will not discolor or injure the concrete.

2.3 CURING MATERIALS

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NOTE: A combination of one or more of the following curing materials may be selected. Omit curing with liquid membrane-forming compound when the use of an antispalling compound is anticipated.
****

2.3.1 Curing Mats

Mats shall consist of a filling material of cotton batts, covered with unsized cloth tufted or stitched to maintain the shape and stability, as approved.

Burlap cloth shall be made from jute or kenaf and shall be plain weave, weighing 10 ounces per square yard 340 grams per square meter, conforming to AASHTO M 182, Class 3.

2.3.2 Moisture-Retaining Cover

Cover shall be fiber-reinforced, two-ply, nonstaining, white waterproof paper; 4-mil 0.102 millimeter, white, opaque polyethylene film; or 4-mil 0.102 millimeter burlap-polyethylene sheet, conforming to ASTM C 171.

2.3.3 Liquid Membrane-Forming Compounds

Compounds shall be spray applied, white pigmented, conforming to ASTM C 309.

2.3.4 Water

Water shall be potable.

2.4 JOINT MATERIALS

2.4.1 Fillers

Preformed fillers shall be nonextruding, resilient, bituminous, conforming to ASTM D 1751.

2.4.2 Joint Sealant

Sealants shall be hot-poured rubber-modified asphalt joint sealer conforming to ASTM D 1190.

2.5 CONCRETE MATERIALS

Aggregates shall conform to ASTM C 33.

Portland cement shall conform to ASTM C 150, Type II.

Water shall be potable.

Air-entraining admixtures shall be subject to prior approval of the Contracting Officer and shall conform to ASTM C 260.

Fly Ash [is required] [used] as an admixture [and] shall conform to ASTM C 618, Class [C or F] with 4 percent maximum loss on ignition and 35 percent

maximum cement replacement by weight.

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NOTE: Ground granulated blast furnace slag and fly ash are materials listed in the EPA's Comprehensive Procurement Guidelines (CPG) (http://www.epa.gov/cpg/). If the Architect/Engineer determines that use of certain materials meeting the CPG content standards and guidelines would result in inadequate competition, do not meet quality/performance specifications, are available at an unreasonable price or are not available within a reasonable time frame, the Architect/Engineer may submit written justification and supporting documentation for not procuring designated items containing recovered material. Written justification may be submitted on a Request for Waiver Form to the NASA Environmental Program Manager for approval. The Request for Waiver Form is located in the NASA Procedures and Guidelines (NPG 8830.1) (http://nodis3.gsfc.nasa.gov).

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Ground granulated blast furnace slag [is required] [used] as an admixture [and] shall conform to ASTM C 989, Grade [120] with between 25 to 50 percent maximum cement replacement by weight.

2.6 CONCRETE-MIX DESIGN

Concrete shall be air-entrained portland cement concrete with a minimum modulus of rupture of [_____] pounds per square inch Megapascal at 28 calendar days, air content of 5 to 8 percent, and maximum slump of 4 inches 100 millimeter. Concrete mix design data shall be provided by an approved testing service.

Ready-mixed concrete shall be mixed and delivered in accordance with ASTM C 94/C 94M or ASTM C 685/C 685M.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

Subgrade shall conform to NASA Section 02315, "EXCAVATION AND FILL." The subgrade shall be dampened to provide a uniform moistened condition at the time the concrete is placed, except in freezing weather.

3.2 FORM WORK

3.2.1 Placing

Forms and their supports shall be designed and placed so as not to damage any previously placed structure.

Forms shall be installed as specified with 1/4-inch 6 millimeter transverse expansion joints spaced at a maximum of 30 feet 9.1 meter on center.

Forms shall be oiled with an approved oil immediately before concrete is

placed.

3.2.2 Removal

Forms shall remain in place for a minimum of 12 hours. Tool contact shall not be made with concrete when forms are being removed. Concrete to be exposed by form removal shall have sufficient strength not to be damaged by the removal operation.

3.2.3 Tolerance

Forms shall conform to line, grade, and vertical position with an allowable tolerance of 1/8 inch 3 millimeter in any 10-foot 3 meterlong section and no more than 3/8 inch 10 millimeter in accumulated deviation.

3.3 PLACING REINFORCING STEEL

Dowels, reinforcing bars, and tie bars shall be spaced and held in position while placing concrete by use of bar chairs or other approved devices and shall terminate 2 inches 50 millimeter from each expansion and construction joint. Installation of reinforcing steel shall be in accordance with ACI 315 and ACI 318/318R.

3.4 PLACING CONCRETE

3.4.1 General

Concrete shall not be placed until the subgrade and forms have been approved. Except in freezing weather, the subgrade shall be dampened as required to provide a uniform moistened condition at the time concrete is placed.

Concrete shall be placed using single-course monolithic construction and shall be consolidated by vibrators or vibratory screeds.

Concrete shall be struck off to true surfaces and floated before excess water has bled to the surface.

Finishing operations shall not begin until the water has disappeared. Applying dry cement as an absorptive material will not be permitted.

Retempered concrete or concrete which has partially hardened shall not be deposited.

3.4.2 Machine Placement

Manufacturer's instructions shall be submitted for Concrete Curbs and Gutters including special provisions required to install equipment components and system packages. Special notices shall detail impedances, hazards and safety precautions.

An automatic curb-and-gutter machine may be used for concrete placement, when permitted, subject to the following conditions:

Contractor shall submit a revised concrete-mix design for approval as required for machine placement. Design for machine placement shall equal or exceed the specified design.

Required cross section and a satisfactory finish shall be obtained.

Curbs and gutters shall be held to line and grade as indicated and shall have expansion, contraction, and construction joints as indicated.

If use of mechanical placement machines produces unsatisfactory work, such use shall be discontinued and the defective work removed. Combination curbs and gutters, formed and placed as specified, shall then be provided.

3.4.3 Hot-Weather Concreting

Hot-weather concreting shall be in accordance with ACI 305R.

3.4.4 Cold-Weather Concreting

Cold-weather concreting shall be in accordance with ACI 306R.

3.5 FINISHING CONCRETE

3.5.1 Exposed Surfaces

Surfaces shall be floated to a smooth and even surface, with sufficient mortar brought to the surface for final finishing. Final surface finish shall be a uniform gritty texture produced by a moistened float, followed by light longitudinal brushing using either a brush or burlap drag. Finished surfaces of combination curbs and gutters shall have a uniform texture free of waves and irregularities. Surfaces shall be true to line and grade with variations no greater than 1/8 inch 3 millimeter under a 10-foot 3 meter straightedge.

3.5.2 Edges and Joints

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NOTE: Radii of curb edges must be indicated on drawings.

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Edges of gutter, back top edges of curbs, and transverse and planes-of-weakness joints (except saw cut) shall be rounded to a radius of 1/4 inch 6 millimeter.

Faces of curbs at top and bottom shall be rounded to the radii indicated on the drawings.

Saw-cut joints shall be square-edge, and the slurry resulting from sawing operations shall be removed from joints and the adjacent concrete.

Edges of joints between sections shall be flush on exposed surfaces.

3.6 JOINTS

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NOTE: Joint details indicated on drawings must be coordinated with project specifications.

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3.6.1 General

Longitudinal and transverse construction, contraction, and expansion joints shall conform to details as indicated.

Joints shall be constructed true to line with faces perpendicular to the surfaces of combination curbs and gutters. Transverse joints shall be constructed at right angles to the centerline of curbs, and shall vary not more than 1/8 inch 3 millimeter from a true line.

Contraction joints constructed with a concrete saw shall be cut as soon as the concrete has hardened sufficiently to prevent edge damage. Joint width shall be approximately 1/8 inch 3 millimeter. Depth of the cut groove shall be approximately 1/4 of the depth of the section or to the depth indicated on the drawings. Sealing grooves shall be cut to the profile indicated on the drawings.

Joints constructed adjacent to or integral with concrete pavement shall be the same type, thickness, and material and spaced to match the joints in concrete pavement.

3.6.2 Construction Joints

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NOTE: Select the applicable paragraph for longitudinal construction joints as determined by the type of pavement.

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Longitudinal joints between combination curbs and gutters and concrete pavement shall be bulkhead or keyed construction, with 3/8-inch 10 millimeter wide by 1/2-inch 13 millimeter deep sealing groove.

Longitudinal joints between combination concrete curbs and gutters and bituminous-concrete pavement shall be unbonded butt joints without dowels or sealing grooves.

Transverse joints between adjoining sections of combination curbs and gutters shall be constructed with doweled butt joints, as indicated on the drawings.

3.6.3 Contraction Joints

Combination curbs and gutters shall have transverse joints at 10-foot 3 meter intervals. Joints may be constructed with metal separator plates, by use of a grooving tool, or saw cut. Depth of joints shall average 2 inches 50 millimeter or more.

3.6.4 Expansion Joints

Transverse joints shall be provided in combination curbs and gutters at a spacing of 30 feet 9.1 meter on center.

Expansion or isolation joints shall be provided where combination curbs and gutters abut concrete sidewalks, manholes, catch basins, inlets, structures, or other fixed objects and at locations and spacing indicated.

3.6.5 Fillers

Premolded joint fillers for expansion joints shall be cut to the profile of the combination curb and gutter and shall extend the full width and depth of the joint. After installation, the top shall be not less than 1/2 inch 13 millimeter and no more than 1 inch 25 millimeter below the finished surface.

3.6.6 Sealant

After completion of the curing period, expansion and isolation joints shall be sealed with the specified joint sealant.

Each joint shall be cleaned of foreign matter, including membrane-curing compound, and joint faces shall be clean and dry when the sealant is applied.

Immediately after cleaning, joints shall be sealed with the specified joint sealant poured to fill joint.

Sealing compound spilled on the surface of concrete or adjacent surfaces shall be removed immediately.

Compound shall be placed in accordance with manufacturer's instructions.

Traffic shall not be permitted over poured joints until the compound has hardened sufficiently to prevent pickup of sealing compound. Sand shall not be used as a cover for seal.

3.7 CURING

3.7.1 General

Freshly deposited concrete shall be protected from premature drying and excessive hot or cold temperatures during the curing period.

****

NOTE: Select one or more of the following curing methods. Water curing is desirable except in winter. Wetted burlap, cotton mats, straw, hay, or polyethylene films are acceptable provided the surface is kept damp. Liquid membrane curing is economical but requires careful procedures when applied during temperature extremes (below 40 degrees F 4 degrees C, above 85 degrees F) 29 degrees C) and shall not be permitted if the use of antispalling compound is anticipated.

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3.7.2 Initial Curing

Except during cold-weather concreting, exposed concrete surfaces shall be wet-cured for a minimum of 48 hours, beginning the process as soon as the concrete has hardened sufficiently to withstand surface damage. Concrete shall be cured by means of one or more of the methods listed:

Continuous water spray:

A continuous water spray of exposed concrete surfaces shall be

achieved by use of soil soaker hoses or fog-spray nozzles operated to keep the surface moist during the curing period.

Burlap or cotton mats:

Exposed concrete surfaces shall be covered with two or more layers of wetted burlap cloth or cotton mats. Material shall be kept saturated with water both night and day, and secured in place during the initial curing period.

Straw or hay:

Exposed concrete shall be covered with clean, loose straw or hay at not less than 4 pounds per square yard 175 kilogram per square meter. Straw covering shall be wetted as soon as it has been placed and kept saturated for the duration of the initial curing period.

Covering displaced during the curing period shall be replaced immediately and wet down.

3.7.3 Final Curing

Final curing of exposed concrete surfaces shall be achieved by continuing the method of the initial wet curing for the duration of the curing period or by use of one of the following:

Moisture-Retaining Covers:

Exposed concrete surfaces shall be covered with moisture-retaining covering sheets. Adjoining sheets shall be lapped by at least 6 inches 150 millimeter and shall overlap ends by at least 12 inches 300 millimeter. Joints shall be cemented or taped to form a continuous membrane. Perforations, tears, holes, or rips shall be immediately patched. Curing sheets shall be folded over exposed edges of concrete and secured in place.

Liquid membrane-forming compound:

Compound shall be applied to exposed concrete surfaces in one or two uniform spray applications at a rate of 200 square feet per gallon 3 square meter per liter of material.

Curing compound shall not be permitted to enter joints, nor shall it be allowed on surfaces to be subsequently joined with other concrete surfaces.

Spraying unit shall be equipped with a calibrated gage to ensure that the specified quantity is applied. Unit shall provide a spray to the surface of the concrete as recommended by the manufacturer.

An additional coat of compound shall be applied to surfaces showing discontinuity of coverage. Areas covered with curing compound and damaged by construction operations within the 7-day curing period shall be resprayed as specified.

Failure to provide complete and uniform coverage will be cause for discontinuation of this curing method.

3.8 DISPOSAL OF WASTE MATERIALS

3.8.1 Removal to Spoil Areas on Government Property

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NOTE: Delete the paragraph heading and the following paragraph when disposal on Government property is not permitted.
****

[Waste materials shall be transported to and disposed in designated spoil areas on Government property as directed by the Contracting Officer.]

3.8.2 Removal from Government Property

****
NOTE: Delete the paragraph heading and the following paragraph when disposal on Government property is permitted.
****

[Waste materials shall be removed from Government property and legally disposed at no additional cost to the Government. Permits and fees for disposal shall be paid by the Contractor.]

-- End of Section --